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## FRESH-WATER MOLLUSKS OF THE OLIGOCENE OF ANTIGUA.

BY AMOS P. BROWN AND HENRY A. PILSBRY.

In a recent paper by one of us<sup>1</sup> reference has been made to the deposits carrying these fresh-water shells, which were first noted by Nugent.<sup>2</sup> His collection of Antigua fossils, including, no doubt, specimens of these fresh-water mollusks, is still preserved in the collections of the Geological Society of London, now in the British Museum. These deposits were later described by Purves<sup>3</sup> as his division E, under the name of the "Lacustrine or fresh-water chert." These beds are mapped by Purves as extending completely across the island, in the central plain from Corbizon Point and Dry Hill in the northwest to near Willoughby Bay and Falmouth Harbor in the southeast. His observations on the fossils appear to have been made at Dry Hill and at Corbizon Point. M. Purves records the following genera as occurring in these cherts: *Melania*, *Zonites*, *Nematura* or *Amnicola*, *Planorbis*, *Melampus*, *Neritina*, *Truncatella*, *Pomatias*. He also states that the specific descriptions of these shells will be published later, but this seems never to have been done.

The species described in this paper were collected from the sea cliffs at Dry Hill, where these flinty beds, carrying fresh-water species, outcrop on the seashore and where they have weathered out by the action of the rains and the salt water dissolving away the calcareous material and leaving the silicified shells intact in a remarkably good state of preservation. When these beds were seen inland at several points, the weathered surfaces of the layers exposing the shells were not so well preserved as at Dry Hill or at Corbizon Point, only sections being found in most cases, as the shells were imbedded in the compact flint. This was, of course, the case at the two localities above noted, likewise; the hard, compact flint layers, varying in thickness from one to four inches, being frequently crowded with these fresh-water shells that showed only in sections upon the frac-

<sup>1</sup> Brown, Notes on the Geology of the Island of Antigua, *Proc. A. N. S. P.*, 1913, pp. 584-616. See also p. 596 of the same paper.

<sup>2</sup> Nugent, A Sketch of the Geology of the Island of Antigua, *Trans. Geol. Soc. London*, ser. 1, Vol. V, (1821), pp. 459-475.

<sup>3</sup> Esquisse géologique de l'Ile d'Antigua, *Bull. Mus. Roy. Hist. Nat. Belg.*, Vol. III, 1884-85, pp. 273-318.

tured surfaces. Where the sea had been eating into the cliff, and detaching slabs of the hard, flinty layers, the surfaces of these flint slabs were completely covered with the flint pseudomorphs of the shells, these in most cases having the finest sculpture perfectly preserved. The relation of these beds to the other members of Brown's division 3 as given in his *Notes on the Geology of the Island of Antigua* is shown in the section of the rocks at Dry Hill, on page 595,<sup>4</sup> and there it will be seen that the *lacustrine or fresh-water chert* layers immediately overlie the *Volcanic Sands* which form the lower 23+ feet of the section. The same sequence of deposits is also seen at Corbizon Point, where the *fresh-water chert layers with silicified wood* occur along the shore immediately above these same *Volcanic Sands* that are found at Dry Hill. Near the Botanic Station, just east of St. John's, the flinty layers with fresh-water shells are found, but the shells are imbedded in the flint and only show in sections in the hard, compact rock. The reddish beds of the *Volcanic Sands* are absent at this locality east of the Botanic Station or are only represented by sandy nodules in the white tuffs. No silicified wood was seen at this place.

The species described below belong to the genera *Hemisinus*, *Bythinella*, and *Planorbis*. The genus *Hemisinus* is undoubtedly what Purves has called *Melania* and indeed he mentions *Hemisinus* as being found living in Cuba. These species of *Hemisinus* are described below. The *Bythinella* is probably what Purves referred to *Nematura* or *Amnicola*; we have described one species. The one *Planorbis* which we describe is the only representative of this genus in the collection. We found no representatives of *Melampus*, *Truncatella*, *Pomatias*, *Zonites*, and *Neritina*, mentioned by Purves.

***Hemisinus antiguensis* n. sp.** Pl. IX, figs. 1, 3, 5, 6.

The shell is slender, diameter contained nearly three times in the length; whorls rather numerous, probably at least fifteen in a perfect shell, as a young one 12.5 mm. long has twelve whorls, the upper part of the spire being very slender. Whorls convex, sculptured with many rounded ribs, as wide as their intervals, somewhat curved, the concavity forward and somewhat protractive. There are about 25 ribs on a whorl. Above the lower suture of each whorl there are two or three spiral cords, the lower one strongest. On the last whorl the ribs extend to the periphery where they disappear, the peripheral region and the base having numerous spiral cords. The aperture

<sup>4</sup> Brown, *loc. cit.*

is but rarely preserved, but in the best examples the peristome seems to be somewhat effuse at the base of the columella.

Length 16.5, diam. 6 mm., 8 whorls remaining.  
" 19.5, " 6.4 " 8 " "

The sculpture of longitudinal ribs with basal spirals is characteristic. The same type of sculpture occurs in various South American species of *Hemisinus*. It could readily be matched also in *Melania* and related forms or in the *Pleuroceratidæ*.

There seems to be variation in the development of the spirals. Many specimens show weak traces of impressed spirals over the ribs throughout, and this seems to be the normal condition; but in some examples the ribs appear to be smooth except near their lower ends.

This species, like the associated forms, has the basal sinus or notch obsolete, as in part of the recent species.

***Hemisinus siliceus* n. sp. Pl. IX, fig. 2.**

The shell is Melaniiform, regularly tapering, the diameter of last whorl contained about  $2\frac{1}{3}$  times in the total length. The whorls are convex, and apparently without any sculpture except growth-lines. The last whorl has fine, reversed sigmoid growth striæ, which retract somewhat below the suture, then advance, as in *H. cubaniana*. In the type specimen a former peristome, indicating a period of growth arrest, appears as a sigmoid varix on the last whorl. This indicates a more strongly sigmoid outer lip than in the recent Antillean species.

Length 26 mm., about 6 whorls remaining, the summit lost; diam. 10.8 mm.

No entirely perfect aperture was found on the slabs collected, but so far as we can judge, it seems to be much like that of *Hemisinus cubanianus* (Orb.). It is not unlikely that *H. siliceus* is ancestral, or at least a collateral species not far removed from the ancestral stock of the smooth Antillean species of *Hemisinus*.

There is, of course, a possibility that this Antigua species belongs to the genus *Pachycheilus*, which is represented in the recent fauna of Cuba by *P. conicus* (Orb.) and *P. violaceus* Prest.; but the straighter columella does not, in our opinion, favor this view.

The type has lost the shell from the spire by conversion into flint, but the surface has been preserved in perfection on the last whorl.

***Hemisinus latus* n. sp. Pl. IX, fig. 4.**

This form is represented by somewhat numerous internal casts, of which the largest has been selected for illustration. It differs

from the associated species by its decidedly broader figure. The diameter of last whorl is contained about  $2\frac{1}{8}$  times in the estimated total length. The whorls, of which somewhat over 5 are preserved in the type, are shorter and broader than in *H. siliceus*. Very little of the shell is preserved and the sculpture is unknown. It is probably smooth. The aperture is largely concealed by another shell, the thin, arcuate, outer lip alone remaining visible.

Length of broken specimen 17 mm.; diameter 8.5 mm.

**Bythinella antiguensis** n. sp. Text fig. 1.

The shell is oblong, pupiform, smooth; outlines of the spire convex, the apex conspicuously obtuse. Whorls 4, very convex, aperture vertical, shortly ovate, its length contained  $2\frac{1}{2}$  times in that of the shell; peristome in one plane, thin.

Length 1.8, diam. 1.1, length of aperture 0.7 mm.

This very minute form is not rare. It has the very obtuse summit and the pupiform shape of the species usually referred to *Bythinella*, rather than the shape of *Paludestrina*, if, indeed, the two groups are distinct. Of course, any generic reference of a minute fossil Amnicoloid shell of this sort is purely provisional, unless it is from a region where the recent fauna and its antecedents are well known.

**Planorbis siliceus** n. sp. Pl. IX, figs. 1a, 3a, 5a, 6a.

This is a species of the section *Tropicorbis*.<sup>5</sup> The shell is rather thick, with the periphery rounded, more convex towards the right side. The two sides are about equal in width of the concavity, but that on the right side penetrates more deeply, being vortex shaped. The last whorl is rounded on this side. On the left side the last whorl is subangular and the cavity is less infundibuliform.

Diameter 3.5, greatest alt. 1.7 mm.

“ 5 “ “ 2.1 “

This species belongs to a widely spread group of the modern tropical American fauna.

PALEOGEOGRAPHIC RESULTS.

The species of *Hemisinus*, as of related genera, are river snails. They do not inhabit intermittent streams, ponds, or lakes, except as the latter may form part of a stream system; and they are equally unknown in brackish water. The occurrence of several well-differentiated species therefore implies the presence of rivers or permanent

<sup>5</sup> *Tropicorbis* n. section, type *P. liebmanni* Dkr.

streams. Melanians are not likely to be distributed by adventitious means from stream to stream, as *Physa*, *Anodonta*, and some other fresh-water mollusks are. Their egg capsules are not gelatinous or likely to adhere to the feet of water fowl, but are firmly fixed to stones, shells, or the like. Wherever their distribution has been studied in detail, it has been found remarkably consistent and explicable by actual stream connections or such as have probably existed within the life of the species or group in question. As the relationships of the Antiguan species are with South America (*H. antiquensis*) and with Cuba (*H. siliceus*), it seems probable that (1) at the stage of the Oligocene when this bed was formed, a considerable land surface existed in the Antiguan area, and (2) that this area was, or had been, connected with the South American main.

It seems likely that the present *Hemisinus* species of Cuba and Jamaica are descendants of the same South American stock. There is in Cuba, however, another totally distinct genus of Melanians, *Pachycheilus*, represented by *P. nigrata* (Poey) and *P. violaceus* Prest. of the recent fauna, which are apparently traceable to a Central American connection.

The other fresh-water snails of the silex bed are not significant. The *Planorbis* belongs to a group widely spread in the recent Neotropical fauna and the "Bythinella" is an ambiguous form of unknown relationships.<sup>6</sup>

#### EXPLANATION OF PLATE IX.

Figures 1, 3, 5, 6.—Slabs strewn with *Hemisinus antiquensis* n. sp. At the positions marked *a* are seen specimens of *Planorbis siliceus* n. sp., the type being 6 *a*.

Fig. 2.—*Hemisinus siliceus* n. sp.  
Fig. 4.—*Hemisinus latus* n. sp.

<sup>6</sup> The generic characters of the fresh-water Rissoids are often not expressed in the shell. A fossil form of simple structure cannot be located generically with any degree of certainty, unless in a region where the characteristics and affinities of the associated fauna have been thoroughly worked out.

